

Claims

[c1] What is claimed is:

1. An in-plane switching mode (IPS) liquid crystal display (LCD) comprising:

a bottom substrate, at least one pixel area being defined on an upper surface of the bottom substrate;

at least one first electrode disposed in the pixel area on the upper surface of the bottom substrate, the first electrode being a protrusion elongated along a first direction;

at least one second electrode disposed in the pixel area on the upper surface of the bottom substrate, the second electrode being a protrusion elongated along the first direction, and the second electrode and the first electrode being in an interlaced arrangement;

a top substrate being in parallel with and opposite to the bottom substrate; and

a plurality of liquid crystal molecules filled in between the bottom substrate and the top substrate;

wherein a longitudinal axis of the liquid crystal molecules is positioned along a second direction and is horizontally arranged between the upper surface of the bottom substrate and a lower surface of the top sub-

strate, and an angle is formed between the second direction and the first direction.

- [c2] 2.The in-plane switching modeliquid crystal display of claim 1 further comprising a first polarizer and a second polarizer disposed on an upper surface of the top substrate and a lower surface of the bottom substrate respectively.
- [c3] 3.The in-plane switching modeliquid crystal display of claim 2 wherein a polarized direction of the first polarizer is parallel to the second direction, and a polarized of the second polarizer is perpendicular to the second direction.
- [c4] 4.The in-plane switching modeliquid crystal display of claim 2 wherein a polarized direction of the first polarizer is perpendicular to the second direction, and a polarized direction of the second polarizer is parallel to the second direction.
- [c5] 5.The in-plane switching modeliquid crystal display of claim 1 wherein the first electrode comprises a transparent pixel electrode or a non-transparent pixel electrode.
- [c6] 6.The in-plane switching modeliquid crystal display of claim 1 whwherein aross section of the first electrode is approximately in a shape of a rectangle, a triangle, or a

semi-circle.

- [c7] 7.The in-plane switching modeliquid crystal display of claim 1 wherein the second electrode comprises a transparent common electrode or a non-transparent common electrode.
- [c8] 8.The in-plane switching modeliquid crystal display of claim 1 wherein a cross section of the second electrode is approximately in a shape of a rectangle, a triangle, or a semi-circle.
- [c9] 9.The in-plane switching modeliquid crystal display of claim 1 further comprising an isolation layer disposed between the first electrode and the second electrode to isolate the first electrode and the second electrode for preventing the first electrode and the second electrode from short circuiting.
- [c10] 10.The in-plane switching modeliquid crystal display of claim 1 wherein both of the first electrode and the second electrode comprise a bump and a conductive layer disposed on a surface of the bump.
- [c11] 11.The in-plane switching modeliquid crystal display of claim 10 wherein a biased electric field perpendicular to the first direction is formed between the first electrode and the second electrode when an external voltage is

applied between the first electrode and the second electrode to accelerate the rotation of each liquid crystal molecule so as to reduce a driving voltage of the in-plane switching mode liquid crystal display.

[c12] 12. The in-plane switching mode liquid crystal display of claim 11 wherein the biased electric field is an electric field in parallel with a surface of the bottom substrate to maintain the rotation of each liquid crystal molecule on a fixed plane.

[c13] 13. The in-plane switching mode liquid crystal display of claim 10 wherein each of the bumps disposed in the first electrode and the second electrode is used for changing the distribution of the biased electric field to enhance the driving ability of the biased electric field to each liquid crystal molecule so as to increase the transmittance of the in-plane switching mode liquid crystal display.

[c14] 14. The in-plane switching mode liquid crystal display of claim 10 wherein a width of both of the first electrode and the second electrode is approximately $3\text{--}8\mu\text{m}$ a spacing between the first electrode and the second electrode is approximately $8\text{--}16\mu\text{m}$ and a height of each bump is approximately $0.5\text{--}2\mu\text{m}$

[c15] 15. The in-plane switching mode liquid crystal display of

claim 1 wherein the liquid crystal molecule comprises a negative dielectric constant anisotropy liquid crystal molecule or a positive dielectric constant anisotropy liquid crystal molecule.

[c16] 16. The in-plane switching mode liquid crystal display of claim 1 further comprising a first alignment layer and a second alignment layer disposed on the lower surface of the top substrate and the upper surface of the bottom substrate respectively.

[c17] 17. An in-plane switching mode (IPS) liquid crystal display (LCD) comprising:
a bottom substrate, at least one pixel area being defined on an upper surface of the bottom substrate;
at least one first electrode disposed in the pixel area on the upper surface of the bottom substrate, the first electrode being a protrusion elongated along a first direction;
at least one second electrode disposed in the pixel area on the upper surface of the bottom substrate, the second electrode being a protrusion elongated along the first direction, and the second electrode and the first electrode being in an interlaced arrangement;
a top substrate being in parallel with and opposite to the bottom substrate; and
a plurality of liquid crystal molecules filled in between

the bottom substrate and the top substrate;
wherein when a voltage is applied between the first electrode and the second electrode, a longitudinal axis of the liquid crystal molecules is positioned along a third direction which is substantially perpendicular to the first direction.

- [c18] 18. The in-plane switching modeliquid crystal display of claim 17 wherein a height of the first electrode is substantially equal to a height of the second electrode.